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COVER: The Dandelion. A maligned member of the Aster Family except for those who appreciate its "blossom wine" or the "greens." All drawings by P. A. Duke

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APRIL ASTERS

JAMES A. DUKE

ASTERS are members of the largest family of flowering plants, a family entitled the composite family or Compositae. This family, and especially the aster, are responsible for the burst of color in autumn, at which time they offer their most magnificent display. Although the true asters are absent from the April flora of Missouri, a few close relatives begin to flower in April, and some of these can be found in March on occasions, especially near cities, where the temperatures are more amicable.

Numbering about a thousand genera, the composite family is a very diverse and widespread group, many of which occur naturally in Missouri. There is almost an equal number cultivated as ornamentals. Among the more familiar ornamentals are anthemis, chrysanthemum, cineraria, coreopsis, cosmos, dahlia, gerbera, marigold, sunflower and zinnia. Of importance as edibles are lettuce *(Lactuca)*, endive *(Cichorium)*, salsify *(Tragopogon)* and the globe artichoke *(Cynara)*. Not to be forgotten are the nuisance members such as the goldenrod, ragweed, dandelion and cocklebur. A few, such as chicory, tansy, costmary, and southernwood, are used as spices and often find a place in the herb garden. It is hoped however that this article will serve to familiarize you with those few Missouri species which begin flowering in April.

The botanical name Compositae is not without significance. How many of you have seen a child dissecting a daisy, repeating, "she loves me; she loves me not"? Many would assume that the child were stripping the daisy of its petals, but the process is more complicated. The composite or aster family, as it is commonly called, is so named because the "flower" is in reality a complex aggregation of several, even hundreds of flowers, grouped together on a common receptacle to form the composite structure known botanically as the *head*. So when the child strips the daisy "flower" of its "petals," he is actually stripping the *head* of several of its constituent flowers.

With this in mind, let us examine more closely the "flower" of the robin's plantain (Fig. 1), one of the earlier composites to flower, and the one superficially most closely resembling the aster. At the same time let us compare it with the true flower of the spring beauty (Fig. 2), a member of the portulaca family, which can be found blooming at the same time as the robin's plantain. The outermost whorl of the spring beauty flower consists of two greenish structures, the

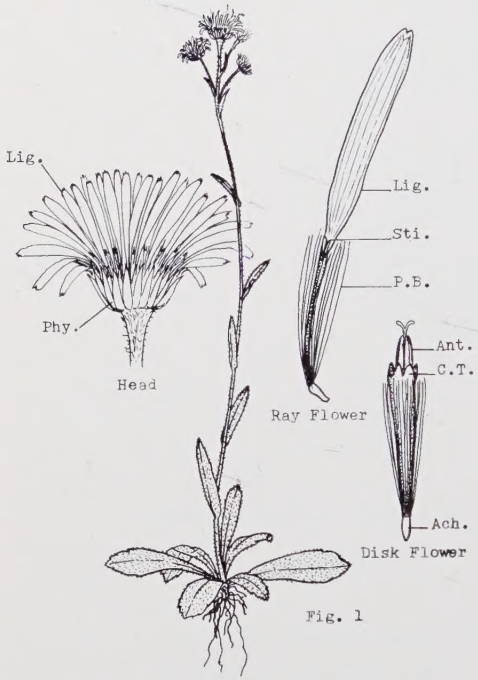

Fig. 1

several flowers will be observed. The collective name for the flowers and the branches upon which they are borne is the *inflorescence*. If we could visualize the condensation of the inflorescence so that all the branches and stalks had fused, we would have visualized something close to the composite inflorescence which is called the *head*.

Outside the head of the robin's plantain is a whorl of green structures, the phyllaries (phy.), which resemble the sepals of the spring beauty somewhat but in reality correspond to its uppermost leaves. In the center of the head of the robin's plantain we will find several minute flowers, which will show several similarities with the larger flowers of the spring beauty. The outermost whorl of this flower, sepals, which are almost round. Inside these are five pink petals, which are longer and narrower than the sepals. Inside the petals are five stamens, which consist of narrow elongated stalks, the *filaments*, (*fil.*) at the tip of which are the anthers (*ant.*), which are yellowish to pinkish and which produce the pollen. The anthers somewhat resemble a football in shape, and upon closer examination are seen to be divided into four quarters. In the center of the flower is the ovary, a globular structure which at maturity will produce about five seeds. At the tip of the ovary is a long stalk, the style (*sty.*), which towards its apex, divides into three short papillate branches (*sti.*), the *stigmata* (sing. *stigma*), to which the pollen is transferred when pollination is effected. On most plants of the spring beauty

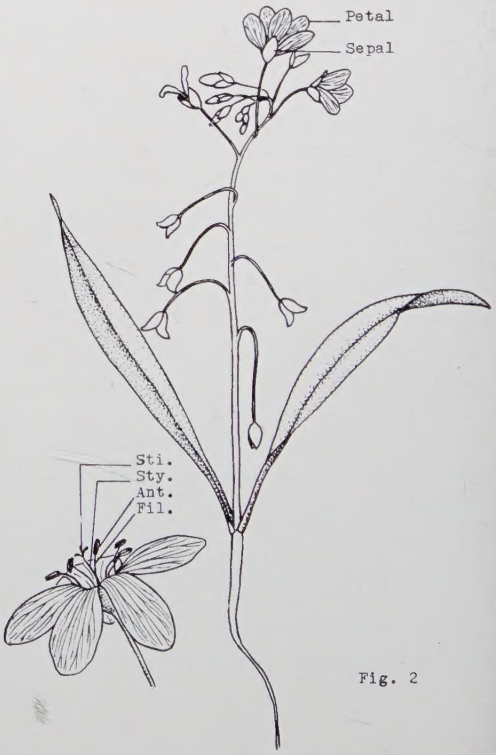

Fig. 2

known as a disk flower, consists of several threadlike bristles, the pappus bristles (*p.b.*) which collectively form the pappus. Although the similarities are remote indeed, the pappus bristles correspond to the sepals (*sep.*) of the spring beauty. Inside the pappus bristles we find a five-lobed tube, the corolla tube (*c.t.*), which corresponds to and more closely resembles the petals of the spring beauty. The petals of the composite have grown together at their base, somewhat like the toes of a duck. The five lobes of the disk flower show vestigially the relationship to the five separate petals of the spring beauty. Inside the corolla tube and scarcely visible to the naked eye are five stamens, the tips of which barely emerge from the tube of the corolla. The stamens also show a tendency toward coherence. Their anthers (*ant.*) have grown together to form a second tube inside the corolla tube. The ovary of the disk flower is completely enclosed within these two tubes and can be located only by dissection, but it will be found to be quite similar to that of the spring beauty, except that it has become fused with the basal portion of the pappus and the corolla tube (*c.t.*). Furthermore, the style has only two stigmata (*sti.*), rather than three as in the spring beauty. The ovary in the composite family forms only one seed and that, inextricably fused with the lower portion of the pappus, is known as the achene (*ach.*). Since there are several flowers in a head, several achenes are normally produced, and the pappus bristles, which usually remain attached to the achene, often aid in their dispersal.

This is merely half of the complicated story of the composite flower. We have studied only the disk flowers which are at the center of the head. At the periphery of the head are more flowers, constructed on a slightly different pattern, and showing even less resemblance to the flower of the spring beauty. These outer flowers, known as *ray flowers* or *ligulate flowers,* have pappus bristles similar to those of the disk. The corolla tubes, however, are very one-sided or asymmetrical, and the outer conspicuous sides form strap-like structures, the rays or ligules (*lig.*), which are usually the most striking feature of the composite flower. To the uninformed these are the "petals" of the daisy. Embraced by the asymmetrical corolla tube of each ray flower are a style and 2 stigmata (*sti.*), similar to those of the disk flower, but the stigmata are visible toward the interior of the ray flower (see figure 1 *sti.*). Stamens are lacking in the ray flowers, which are thus unisexual (female), as contrasted to the bisexual disk flowers.

This brief introduction to the composite flower may serve to explain why many naturalists, as well as amateurs, tend to avoid and pass by the numerous and sometimes quite attractive members of the composite family. Due to their complexity and multiplicity, the family is a difficult one to master in a short time. Variability might be added to the list of characteristics of the composite family. We have come to find that the so-called flower is actually a head, an aggregation of several flowers, and in a single head are two quite different types of

flowers, the symmetrical disk flowers toward the center, the "eye" of the ox-eye daisy, and the asymmetrical ray or ligulate flowers toward the periphery, the "legs" of the spider chrysanthemums. This arrangement is only one of many variations on the composite theme. In some genera all the flowers in a head are symmetrical (discoid) while in others all are asymmetrical (ligulate). In some genera all flowers are of one sex on one plant and of the opposite sex on another; in others, the inner flowers in a given head may be of one sex, while the outer may be of the other, or completely asexual; converse relationships also exist. In some plants, the heads are themselves aggregated into compound heads. To describe the variables and their combinations would be tantamount to describing the thousands of species of composites, a monumental task. Let us limit ourselves for the present to a basic understanding of the composite head, and at the same time familiarize ourselves with the seven genera which bloom in April here in Missouri.

One of the best tools for plant identification is the dichotomous key, which works by offering two alternatives. A series of couplets are contrasted, alternate members of the couplet bearing the same letter. To identify your plant, read each member of the couplet; only one will apply to the plant you are identifying. Following the applicable member will be either a letter which directs you to the next couplet or, if you have beginner's luck, the name of your plant. One should pursue the couplets until he arrives at the name of the plant. Then the plant is no longer a mystery but an addition to the list of "wildflowers I have known." April has few composites, and the fewer the alternatives, the easier the key. Why not pick the first composite you see this month and try to identify it with the key. And remember, if the first *a* does not apply to your plant, proceed to the second *a*. In case the key fails you, brief descriptions and helpful illustrations follow the key. You will find it more rewarding to use the key first and corroborate your identification with the illustrations, but you may find it a trifle easier to pass the key and identify by means of the illustrations.

KEY TO APRIL-FLOWERING COMPOSITES

a. Plants without milky sap; some or all flowers without ligules. (Proceed to *b* if this is true of your plant; to the alternative *a* if untrue).

b. Ligules yellow—Squawweed *(Senecio)* (1)

b. Ligules not yellow, sometimes completely absent (proceed to *c*)

c. Heads without ligules ("petals")—Pussy Toes *(Antennaria)* (2)

c. Heads with white or lilac ligules (proceed to *d*)

d. Stem leaves less than 1/8 inch broad; pappus with only 5 bristles — *(Chaetopappa)* (3)

d. Stem leaves at least 1/4 inch broad; pappus with many bristles — Robin's Plantain *(Erigeron)* (4)

a. Plants with milky sap; all flowers ligulate (proceed to *e*)
   e. Achenes without pappus bristles at the top—*(Apagon)* (5)
   e. Achenes with conspicuous bristles at the top (proceed to *f*)
      f. Leaves merely toothed; heads ¼ to 1 inch broad; pappus bristles emerging from top of achene — Dwarf Dandelion *(Krigia)* (6)
      f. Leaves deeply lobed; heads at least 1 inch broad; pappus bristles on a stalk emerging from the top of the achene—Dandelion *(Taraxacum)* (7)

1. *Senecio,* Squaw-weed, Ragwort (Fig. 3). Characterized by the bright yellow ligules and the leaves which are often egg-shaped, this large genus has several species expected to bloom in April. The silky bristles on the achene are numerous and lack the stalk so characteristic of the dandelions. Were it not for the lack of milky juice, this could conceivably be confused with the dwarf dandelions. In the dwarf dandelion, by means of contrast however, every flower in the head has a ligule, whereas in the squaw-weed only the outer flowers have the ligule. *Senecio* is one of the largest genera in the composite family, and classification of the species is very involved. The butter-weed, *Senecio glabellus,* differs from the others in having no basal leaves, or in having the basal leaves, when present, deeply lobed, the lobes extending almost or completely to the midrib of the leaf. The golden ragwort, *S. aureus,* is characterized by having all or most of the basal leaves shaped somewhat like a valentine. Bruising the upper leaves and phyllaries will often yield a peculiar and delicate odor. *Senecio plattensis,* the prairie ragwort (Fig. 3), and *S. pauperculus,* two closely related species of the prairies and glades, both have leaves which are tapered to the base and often (at least in *S. plattensis*) have a characteristic wooly appearance. These species lack the delicate odor in their phyl-

Fig. 3

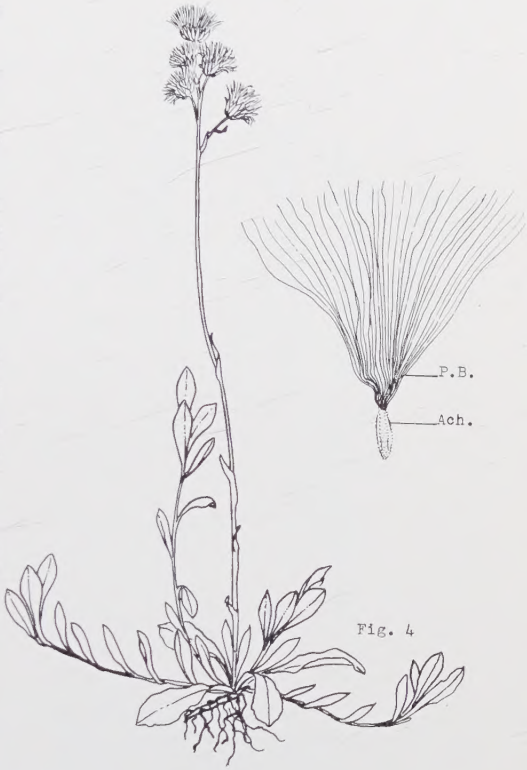

Fig. 4

Fig. 5

laries. Another closely related species, *S. obovatus*, has spoon-shaped or nearly round leaves which are not woolly. It is further differentiated from the preceding by producing runners somewhat like a strawberry.

2. *Antennaria*, Pussy Toes, Everlasting, Ladies' Tobacco (Fig. 4). Pussy toes stand out from other early-flowering composites in that they have no ligulate flowers, i. e., all the flowers are discoid. The distinctive silvery cast of the flowers, rivaled by the pussy willow, also occurs on the stem and leaves. The basal leaves persist throughout the winter. In some plants all the heads are male and in other plants, all are female; the female plants are usually more robust. Three species flower in April. In *Antennaria neglecta*, the female of which is illustrated in Fig. 4, the basal leaves have only one rib. Of the other two species, both of which have three ribs in the basal leaves, *A. plantaginifolia* has phyllaries less than $\frac{5}{16}$ of an inch long, while *A. fallax* has the phyllaries longer. Picked at the right stage (before the fruits have fully matured), the plants are nice for dry floral arrangements, and persist for some time. This explains the common name "Everlasting."

3. *Chaetopappa* (Fig. 5). As in *Zinnia, Dahlia, Cosmos* and several other genera, the Latin name is most commonly used for this genus, represented in Missouri by one species, *Chaetopappa asteroides*, which is not very common. The plant is rather inconspicuous with small narrow leaves. The color of the rays varies from white to lilac, as do those of the robin's plantain, which however has numerous and conspicuous silvery pappus bristles. The pappus of *Chaetopappa* has only five bristles (*p.b.*) although there are some minute scales (sca.) intermixed with them.

4. *Erigeron* (robin's plantain) (Fig. 1). The robin's plantain is the first of the Erigerons to bloom in spring, and it is probably the most attractive of them, closely resembling the true *Aster* of autumn. Since it was discussed in the explanation of the composite flower, there is little to add except to call attention to the numerous pappus bristles which, as in many composites, are responsible for the widespread dispersal of the seeds. The leaves are rather hairy but not so attractive as those of *Antennaria*. Robin's plantain is more common in southern than northern Missouri.

5. *Apogon* (Fig 6). Apogons are closely related to the dwarf dandelions (and included in the genus by recent taxonomists). The differences are rather technical and they are rarely observed by the amateur; hence the Apogons seem also to have acquired no colloquial names in Missouri. The genus is represented in Missouri by only one species, *Apogon oppositifolia*. As the name implies, the leaves on the stem arise in pairs, with one member directly opposed to the other at a given point

Fig. 6

Fig. 7

on the stem. These dwarf plants are characterized by the milky sap exuded when the stem is broken, and furthermore by a waxy, bluish coating on the leaves which may be rubbed off with the finger. The long leaves are asymetrically toothed as a rule, although many leaves on a given plant may be quite smooth-edged. Leaves of many composites often exhibit such an array of variation that the only adjective that can be surely applied to them is *variable.* The heads consist of about 20 florets, each of which has a yellow ligule (*lig.*). On the uppermost part of the floral stalk just below the head may often be found a tufted ring of toadstool-shaped hairs, scarcely visible to the naked eye. These also occur in some of the dwarf dandelions. The achenes (*ach.*) usually lack the bristles so characteristic of the dwarf dandelions however. Apogons are more common in the southern part of the state.

6. *Krigia,* Dwarf Dandelions (Fig. 7). Of the four species of *Krigia* expected in the April flora of Missouri, only one, *Krigia biflora,* has leaves on the stem as does *Apogon,* but the flowers of *K. biflora* are much larger than those of the Apogon. Of the dwarf dandelions the easiest to recognize is *K. dandelion,* which has a bulbous root sometimes an inch in diameter [see Fig. 7 (*bul.*)]. The flowers of *K. dandelion,* as those in *K. biflora,* which lacks the bulbous root, are nearly as large as those of the true dandelions. The two remaining spring-flowering dwarf dandelions have smaller flowers, and the characters separating them are difficult to discern with the naked eye. Each head of *K. occidentalis* has eight or fewer triangular phyllaries with a prominent midrib. In *K. virginica* there are nine or more phyllaries and they are very narrowly triangular, approaching the grass blade in their proportional dimensions. These four species of *Krigia* are more common in the southern part of the state.

7. *Taraxacum,* Dandelion (see cover). The dandelion is probably as well known as any of the Missouri weeds, and it is nearly as infamous as crabgrass. But since this is our first lesson in composites, let us take a closer look at this culprit. The outer green structures on the head are the phyllaries. In the red-seeded dandelion *(Taraxacum laevigatum)* they are constricted at the tip like a tenpin, whereas they are rather evenly drawn out to the tip in the common dandelion *(Taraxacum palustre).* In early spring the whole interior of the flower-head is bright yellow. Examination shows that the yellow belongs to the strap-shaped ligules (*lig.*), each ligule representing one floret. Later in the season the yellow will disappear after the florets have matured, and each will be represented by a single achene (*ach.*) which, in the red-seeded dandelion, is reddish-brown, and in the common dandelion is olive-brown. At the top of the seed on a long and conspicuous stalk are the ends of the pappus bristles, the whole pappus resembling the skeleton of a broken umbrella, and these seeds can be carried for miles by the wind as a result of this parachute-like construction of the pappus. So if lawns are your interest, and you consider the dandelion a pest, or if wines and greens are your interests, and you consider the dandelion an epicurean godsend, why not examine the flower more closely? There is more there than meets the unobservant eye.

THE STRUCTURE OF THE ORCHID FLOWER

ROBERT L. DRESSLER

THE remark is frequently heard that the iris flower is "just like an orchid." Of course, such a statement comes only from someone who is not very observant. But how can we compare an orchid flower with more ordinary flowers? It is difficult to see stamens and pistils in the flower of an *Odontoglossum* or a *Vanda*, yet these *are* truly flowers, and they have evolved from more ordinary flowers in the course of geological time. There is much that we do not know about the evolution of the orchid flower, but what is known is enough to make a fascinating and enlightening study.

The orchid family belongs to that major division of the flowering plants which the botanist calls the "Monocotyledoneae," or simply, the monocots. These plants have their parts in three's (rather than four's or five's), and so it is this basic plan which we expect to find in the orchids. We may conveniently compare the orchid flower with the lily or the amaryllis, which are rather typical monocots. The lily flower has all of its parts in sets of three—two sets of three petals, two sets of three stamens, and one three-parted pistil. Interestingly enough, these sets show a regular, geometric alternation from the outside of the flower to the center (see figure 1).

THE DISTINCTIVE FEATURES OF THE ORCHID FAMILY

If we study only the most complex and highly evolved orchids, we could find any number of features to distinguish them from other plants. However, if we take the whole orchid family, including some of the small-flowered species which are scarcely ever cultivated, it becomes much more difficult to "define" the orchids. Some of the more primitive orchids have flowers which are really very much like those of other plants. Of the several features listed below as characteristic of the family, only three of them are found in all orchids. Since any one of these features may be found

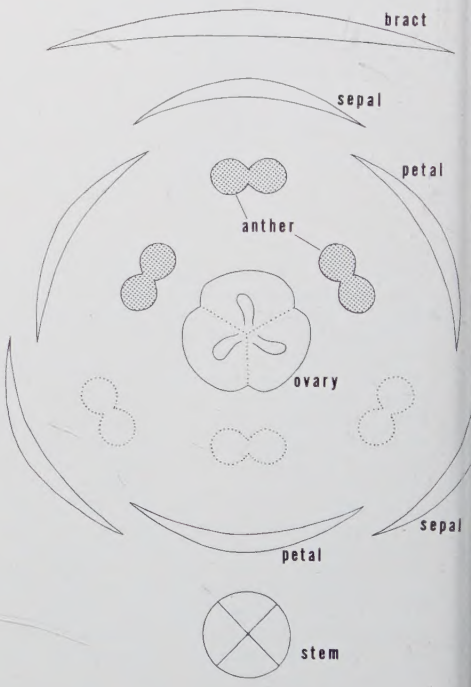

Figure 1. Diagram of a monocot flower, showing the parts which are present in orchid flowers. The petal which is next to the stem in bud becomes the lip in the orchid flower. Two of the anthers of the outer set and one of the inner set (here shown by dotted lines) are never developed in normal orchid flowers.

in other kinds of plants, it is really the combination of features which indicates an orchid, rather than any one "key" feature.

1. The stamens are all on one side of the flower, rather than being symmetrically arranged.
2. The stamens and pistil are at least partly grown together.
3. The seeds are tiny and numerous.
4. The flower usually has a lip.
5. The flower usually twists around in the course of development.
6. Part of the stigma (the rostellum) is usually involved in transferring the pollen from flower to flower.
7. The pollen is usually bound together in few large masses (which may be either soft or hard).

This listing of the features which are distinctive for the family does not begin to outline the complexities of orchid structure. So let us consider each part of the orchid flower in greater detail, starting at the base and working upwards through the column.

Ovary

In the lily flower we find a three-parted ovary in the center of the flower, and this develops into a capsule when the flower is pollinated. In the orchids the capsule appears to develop from the stem beneath the flower. In some distant ancestor of the orchids the bases of the sepals, petals and stamens grew to the ovary to an ever increasing degree,* until these parts seem to be attached above rather than beneath the ovary. The ovary which is beneath the flower and covered by a sheath of sepal, petal and stamen bases is called "inferior" by the botanist, but this refers to its position, rather than its quality. This is actually an evolutionary advancement over the "superior" ovary. The ovary of an orchid is especially hard to find because of an economy which is general in the orchid family. In many flowers the "ovules" or embryonic seeds are all ready for fertilization when the flower opens, but in most orchid ovaries the ovules are not present when the flower opens and they do not develop unless pollination takes place. That is why there is such a long time between pollination and actual fertilization in many orchids.

The ovary, style and stigma of the orchid are basically made up of three parts or "carpels," but these structures are so modified and grown together that they are scarcely recognizable. When the capsule opens it does not split between the carpels, but each carpel splits down the middle. If you want to see recognizable carpels, you should study the fruit of larkspur, columbine or peony.

The lip of the orchid flower is on the upper side of the bud but the ovary and the stem or pedicel, beneath it, usually twist so that the lip is lowermost in the open flower. Thus, the orchid flower is usually upside-down as compared to other flowers, and this is so general that the species which have their flowers right-side-up appear upside-down to us, which is a bit confusing. This process of twisting in the bud is technically known as "resupination."

*When we speak of parts being "grown together" we do not mean that they develop as separate parts and then grow together. Rather they grow as a single structure from the first blob of tissue which starts the flower.

Sepals and Petals

The two sets of petal-like parts in the lily flower are so similar that the botanist does not speak of them as sepals and petals, but uses the collective term perianth. It is customary, though, to speak of sepals and petals in the orchid flower, even though the outer segments are not green, as true sepals usually are. The two sets are usually rather different in the orchids, so there is some justification for this distinction. The outer set are simply called sepals, and the inner set, or two of them, petals. The inner segment which is opposite the fertile stamens is called the lip, and is usually quite different in shape, and sometimes in color, from the other five segments. It is usually the lip which gives character to the orchid flower, but there is great variation in the size and arrangement of the sepals and petals. Either two or all three sepals may be grown together, and the lip, the petals, or even the lateral sepals may be grown to the column. The number of variations which occur on the basic pattern of 3 sepals, 2 petals and a lip is truly remarkable.

That one of the petals forms the lip and that the stamens are all on one side of the flower, points to the basic difference between the orchid and the iris. The iris has three stamens, as a few orchids do, but they are symmetrically arranged, being one of the two sets found in the lily flower. The orchid is bilaterally symmetrical. It can be cut down the middle into two halves which are mirror images, but (like ourselves) it can be cut into equal and similar halves only along that one line. The iris or lily can be cut into equal halves along several different lines, since they have a basically radial symmetry.

Nectaries

Any structure which produces a sugary solution, or nectar, is classed as a nectary, and there are several types of nectary in the orchids. Many orchids have small nectaries on the outside of the sepals, which secrete nectar while the bud is developing. This activity may in some way be associated with the high rate of growth of the flower buds. Shallow, cup-like nectaries within the flower are known in many species, especially those that have a "column foot" (described below). The most conspicuous sort of nectary is the long tubular "spur," such as we find in *Angraecum, Calanthe* or *Habenaria. Cattleya* and several related genera have long tubular nectaries embedded in the base of the flower, alongside of the ovary. These are most striking in *Brassavola,* where they may be as long as six or seven inches.

Column

The column is one of the best known characteristics of the orchid family. Where most other plants have separate stamens and style in the center of the flower, these structures are united into a single organ in most orchids. In most of the better known orchids the stamens and style are grown together for their full length, but they are only partly united in *Cypripedium, Spiranthes, Neuwiedia,* and some other genera. At one time it was thought that the column was a stem structure,

Figure 2. Diagram showing how the three fertile anthers of the primitive orchids (A) have been modified. In the ladyslippers and *Apostasia* (B) the lateral anthers are fertile and the median anther is sterile or absent. In most orchids the median anther is fertile and the lateral anthers are sterile (C) or absent (D).

but we now realize that the stem ends at the base of the ovary, and the column is only the style and parts of the stamens, united and thickened. Many orchids show a peculiar structure known as a column foot. This is a ventral outgrowth at the base of the column, which has the lip jointed to its tip. This is especially striking in many species of *Dendrobium* (see figure 6).

Anther

In some orchids the anther, which is the pollen-bearing part of the stamen, is very like that of the lily or amaryllis. The ordinary sort of anther is an oblong structure with four long pollen-sacs which become two before the anther splits open to release the pollen. The anther is usually attached to a long slender "filament" at or near one end. In most orchids the filament is almost completely grown to the column, so that only its tip can be recognized as such. In most of the familiar orchids the anther is a cap-like structure sitting on the tip of the column, with the pollen beneath it. In the *Habenaria* group the anther projects beyond the rest of the column, but its base is so completely grown to

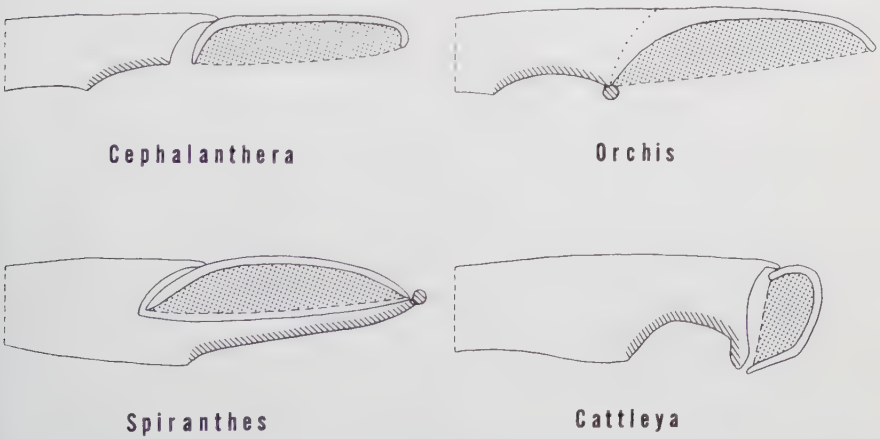

Figure 3. Diagram showing the position of the anther in different genera; the stigma is shown by hatched lines, and the pollen by stippling. In *Cephalanthera* a very unspecialized anther projects beyond the tip of the column. In *Orchis* (or in *Habenaria*) the anther projects beyond the column, but is solidly grown to the column at its base; the bases of the pollinia are attached to a viscidium (part of the stigma). In *Spiranthes* the anther is on the back of the column and the apices of the pollinia are attached to the viscidium. In *Cattleya* the anther sits on the apex of the column like a cap, and part of the stigma (the rostellum) projects downward next to the anther.

the column that one cannot tell where the column stops and the anther starts. Another peculiarity of this group is that the two halves of the anther are often widely separated, with a band of anther tissue or "connective" between them. It has sometimes been suggested that these orchids have two anthers, like the ladyslippers, but their structure and development indicate that this is not the case.

Pollinia

A few orchids have powdery pollen with separate grains, like other plants, but in most orchids the pollen grains are at least loosely bound together in masses or "pollinia." In *Spiranthes* or *Epipactis,* for example, the pollinia are two or four soft, fluffy masses which are bound together by "viscin," an elastic, somewhat viscid material derived from the tissues of the anther. There are two major types of specialization in the structure of the pollinia. In the *Goodyera* and *Habenaria* groups the pollinia are soft and mealy, as in *Spiranthes,* but each pollinium is divided into many small packets, which are attached to a viscin core by strands of viscin. When a bee carrying *Habenaria* pollinia brushes the stigma of another flower a few of the packets stick to the stigma and the viscin strands stretch and break, leaving the packets in the stigma. Thus, a single pollinium can pollinate many flowers. The pollinia which are divided into packets in this way are termed "sectile," and the packets are termed "massulae."

In the largest of the orchid tribes, the Epidendreae, we have a complete series from the soft mealy pollinia of

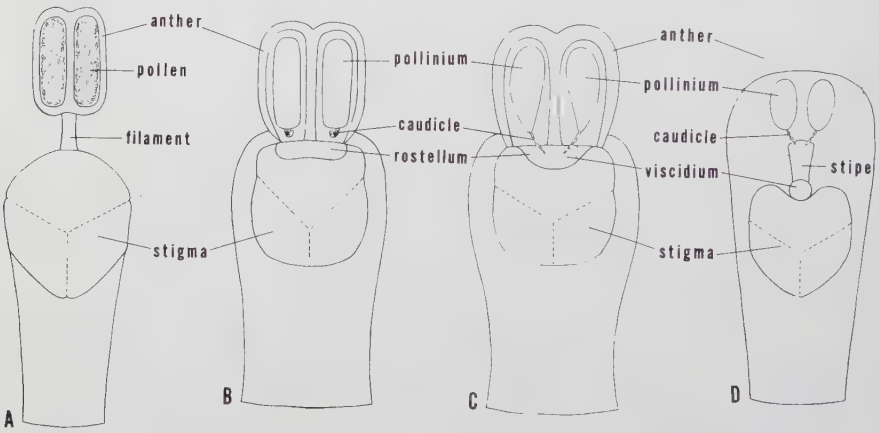

Figure 4. Diagram showing the evolution of the orchid column. The first figure (A) represents a primitive orchid similar to *Cephalanthera,* with an ordinary anther, and a simple, three-lobed stigma. B represents an orchid in which the pollinia are compact and hard except for the mealy caudicles; and part of the stigma is specialized as the rostellum. This is similar to *Cattleya.* In (C) the caudicles of the pollinia are attached to a part of the rostellum (viscidium) which is removed as a unit with the pollinia. *Cymbidium* is of this sort. (D) represents a highly evolved orchid such as *Oncidium* or *Vanda,* in which there is a strap, or "stipe," attaching the viscidium to the pollinia. In (B) and (C) the anther is shown as projecting beyond the column, to show the parts more effectively, but such orchids normally have the anther sitting on the apex of the column as shown in figure 5 (A).

Sobralia, through the more compact pollinia of *Phajus*, to the rather hard pollinia of *Cattleya* and the very hard pollinia of *Oncidium* or *Vanda*. In this group the hard "waxy" pollinia usually bear a small amount of mealy pollen with viscin strands, which serves to attach the pollinia to each other or to the viscidium (see below) and is often the part glued to the visiting insect. This mealy portion of the pollinium is termed the "caudicle." The anther of the Epidendreae may contain either 2, 4, 6, 8 or occasionally 12 pollinia.

Stigma

The three-parted nature of the pistil is reflected in the stigma, which is usually a shallow depression on the underside of the column, but is a mound-like structure in the lady-slippers. The three lobes of the stigma are quite thoroughly grown together, but are frequently separated by faint lines on the surface of the stigma. The stigma produces a sticky, sugary solution in which the pollinia become stuck. This solution is of the right concentration to stimulate the pollen grains into growth. Each pollen

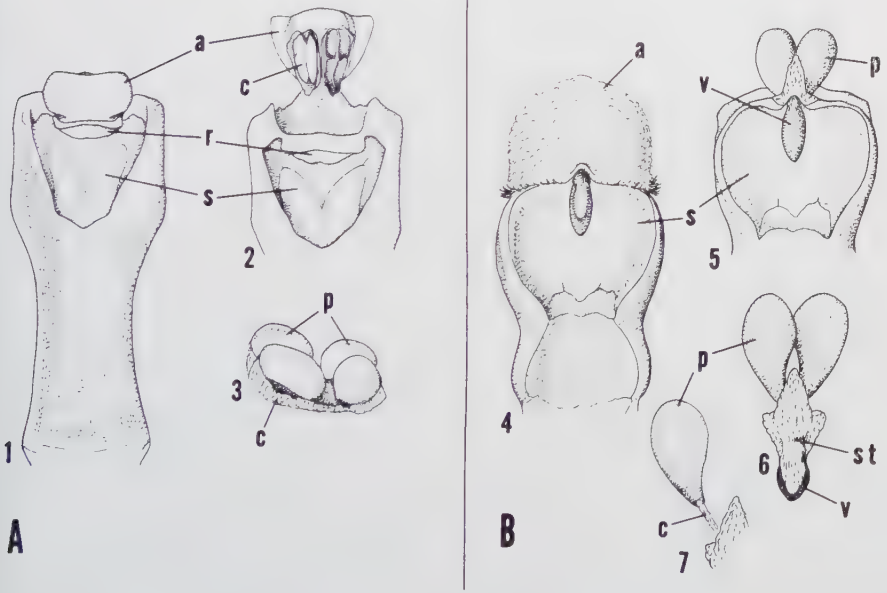

Figure 5. Column structure in two different orchids. (A) shows the column of a *Schomburgkia* (or *Laelia*), in which the structure is similar to *Cattleya*. The rostellum (r) projects below the column where a visiting insect will receive some of its glue in backing out of the flower. In the process it will tip back the anther (as in 2) and the mealy caudicles will stick to the glue-covered back of the insect. (B) is the column of a *Brassia* (similar to *Oncidium*), in which there is a well developed viscidium (v) or sticky pad which will attach to the visiting insect, and a stipe (st) or non-sticky strap attaching the pollinia to the viscidium. In 7 the pollinium (p) is pulled away from the stipe to show the caudicle (c). a, anther; c, caudicle; p, pollinia; r, rostellum; s, stigma; st, stipe; v, viscidium.

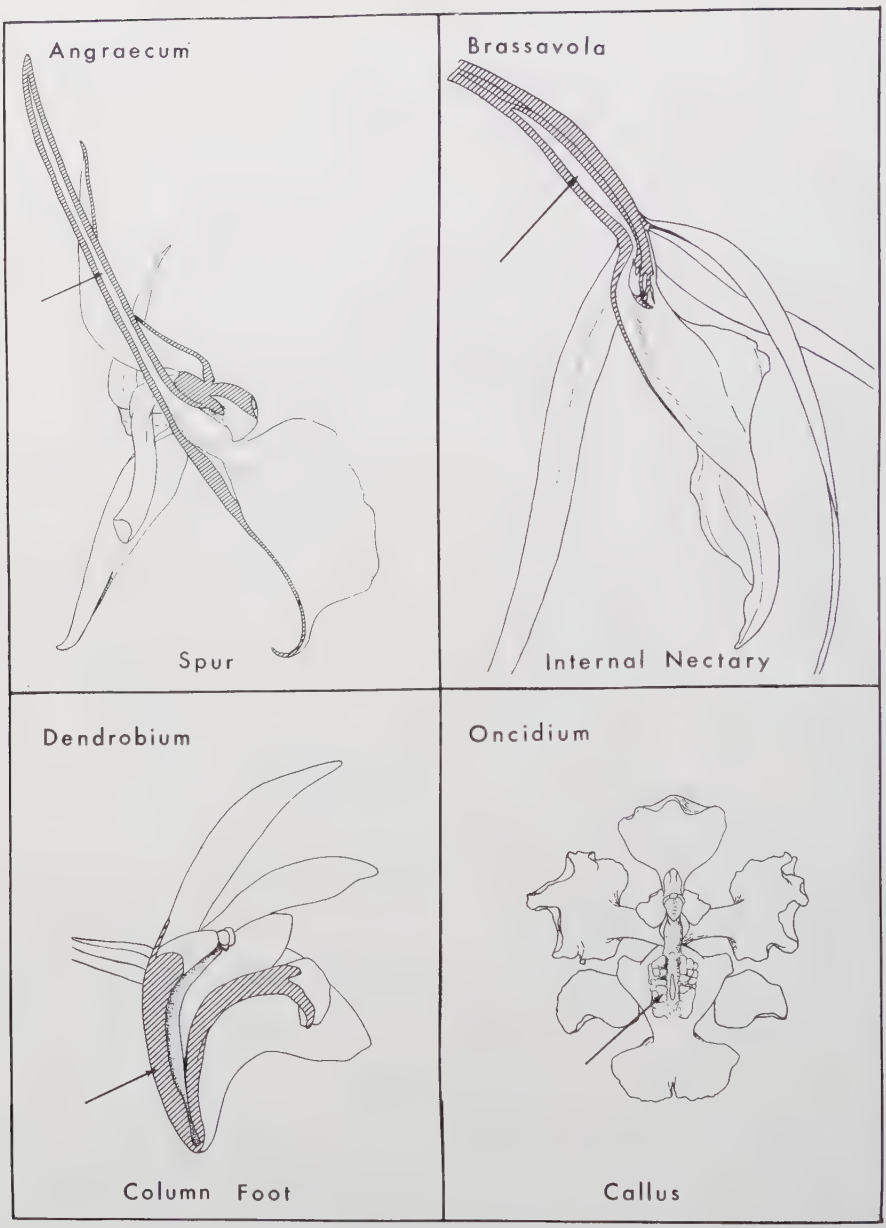

Figure 6. Some special features of orchid flowers. The section through an *Angraecum* flower shows a long spur developed from the base of the lip. In the *Brassavola* the nectary is internal and can be seen only when the flower is cut open. The base of the column in *Dendrobium* is extended into a long "foot," which has the lip hinged to its tip and has a nectary near the tip. The lip of *Oncidium* shows an ornate callus.

grain produces a slender tube which grows down the length of the column and into the ovary, where fertilization takes place. The special interest of the stigma is in that part of it which is discussed next.

Rostellum

One of the outstanding features of orchid evolution is the way a part of the stigma takes part in pollen transfer in the majority of orchids. The part of the stigma that is so specialized is called the rostellum. In the primitive genus *Cephalanthera* there is no rostellum, but insects leaving the flower usually pick up some of the stigmatic fluid on their backs and the pollinia stick to this fluid. In *Cattleya* a special part of the stigma (rostellum) sticks down in front of the anther, so that the visiting insect is almost sure to brush this part and pick up some of the glue which it produces. The flower is so designed that the insect will also tip the anther back and hit the caudicles of the pollinia with its glue-covered back or head. When it enters another flower, the pollinia stick to the stigma and the soft caudicles break. A further specialization of the rostellum is seen in *Cymbidium, Epidendrum* and *Sophronitis*. In these genera the caudicles of the pollinia are already attached to the rostellum before the insect arrives, and a portion of the rostellum comes off as a sticky pad, or "viscidium," with the pollinia. While this is quite a fancy structure in its own right, this is not the end of its specialization. In *Oncidium, Vanda, Stanhopea* and many other genera there is a strap of non-sticky tissue from the column which attaches the pollinia to the sticky viscidium. This band of tissue, or "stipe," is the elastic of Catasetum's cleverly contrived sling-shot, and the large pollinia of *Catasetum* show the viscidium and stipe very well. The stipe should not be confused with the caudicle, as the caudicle is a part of the pollinia, and derived from the anther, while the stipe is not. Orchids which have a well developed stipe usually have also short caudicles attaching the pollinia to the end of the stipe.

The rostellum is generally said to be one of the three stigma lobes, but this idea has sort of fallen to pieces lately because a few inquisitive botanists looked at orchids, instead of reading the authoritative works of their illustrious predecessors, and found that the rostellum is a *part* of one of the lobes of the stigma, but it is rarely or never the whole lobe.

A Glossary of Terms Describing the Orchid Flower

I have tried to bring together here some of the commoner botanical terms, such as sepal, petal and anther, along with all of the special terms which have been used to describe the orchid flower (in English). Do not feel that you need to know nearly sixty terms to understand the orchid flower. The average grower will get along quite nicely with ovary, sepal, petal, lip, column, pollinium and stigma. The reader with more than average curiosity will likely learn anther, rostellum resupinate, nectary and spur; while a few will want to understand even callus, caudicle, viscidium and stipe. Most of the other terms are of interest only to the specialist, and even he could get along without many of them, with a little effort. In several cases, more than one term has been used for the same structure; in such cases we will list the preferred or best-known term in **boldface** type and the synonyms in *italics*.

Acranthous. The inflorescence terminating the vegetative shoot, as in *Cattleya* or *Epidendrum*; the term is rarely used (see also pleuranthous).

Androclinium. = clinandrium.

Antenna; pl. **antennae.** A slender appendage on each side of the column of *Catasetum*, the "trigger" which sets off the pollen throwing mechanism (*cirrhus*).

Anther. The pollen bearing structure of a flower (see also stamen).

Appendage. = caudicle.

Auricle. A small lateral outgrowth on the column of *Habenaria* and allied genera, possibly a sterile anther.

Autogamous. Self-pollinating, without the aid of insects or other visitors (see also cleistogamous).

Bract. A small leaf-like or scale-like structure at the base of the flower (below the pedicel).

Bursicle. A sack-like covering over the viscidium in some genera of the *Habenaria* group.

Callus. A crest or fleshy outgrowth of the lip, as in many species of *Oncidium*.

Carpel. A leaf-like structure which bears the ovules and seeds. In the orchids the three carpels are so modified and united that they are scarcely recognizable.

Caudicle. A portion of the pollinium which is usually slender and is composed of viscin with some pollen grains; often confused with stipe (*appendage*).

Cirrhus. = antenna.

Claw. Narrow basal portion of a lip or petal.

Cleistogamous. Refers to flowers which automatically pollinate themselves without opening; a form of autogamy.

Clinandrium. The cup-like apex of the column which partially surrounds the anther, "anther-bed" (*androclinium*).

Column. The central portion of the orchid flower, which is formed by the partial or complete union of the male and female parts (stamens and style). (*gynandrium, gynostegium, gynostemium*).

Column foot. A ventral extention of the base of the column which has the lip attached at its tip; very well developed in *Dendrobium*.

Column wing. A lateral projection from the column, as in *Oncidium*; these may sometimes represent sterile anthers.

Cuniculus. A nectary which is concealed within the ovary or pedicel, as in *Brassavola*; the term is rarely used.

Dorsal. Referring to the upper side of the flower, as the orchid flower is usually borne, as in "dorsal sepal" (see also ventral, lateral, median).

Epichile. The terminal portion of the lip in *Stanhopea* and related genera (see also hypochile, mesochile).

Filament. The slender, sterile portion of the stamen which bears the anther, forms a part of the column in the orchid flower.

Gland. = viscidium.

Gynandrium. = column.

Gynostegium. = column.

Gynostemium. = column.

Granular. Refers to pollen masses which are soft and mealy, as in *Spiranthes* or *Epipactis*.

Hypochile. The basal portion of the lip in *Stanhopea* and related genera (see also epichile, mesochile).

Incumbent. Refers to the anther which is bent downward, rather than parallel with the column (erect), as in *Cattleya*.

Isthmus. The narrow middle portion of the lip in species which have a wide gap between the lateral lobes and the mid-lobe, as in *Cattleya granulosa*.

Labellum. = lip.

Lamina. The broad flattened portion of a lip, petal or leaf.

Lateral. To either side of a vertical line drawn through the center of the flower, as in "lateral sepal."

Limb. The flat expanded portion of the lip, as opposed to the throat or claw.

Lip. One of the three petals which is usually larger and differently shaped than the other two, the median petal (*labellum*).

Massula; pl. **massulae.** A packet of pollen in those genera which have the pollinia subdivided into small packets (see also sectile).

Median. Along a vertical plane through the center of the flower and from front to back; thus the dorsal sepal may be called the median sepal; the lip, column and anther are normally median in position.

Mentum. A chin-like extension at the base of the flower; conspicuous in *Polystachya* and many species of *Dendrobium*, associated with the column foot.

Mesochile. The middle portion of the lip in *Stanhopea* and related genera (see also epichile, hypochile).

Nectary. A nectar producing structure (see also spur and cuniculus).

Operculate. Lid-like, may be applied to anthers which rest on the apex of the column like a cap (see also incumbent).

Ovary. That part of the flower which develops into the fruit; the base of the pistil.

Ovule. The structure which develops into the seed.

Pedicel. The stem which supports an individual flower, usually jointed at the base. This word has also been used to designate the stipe of the pollinia, but this is too confusing.

Peduncle. The stem which supports one or many flowers; the pedicels are attached to the peduncle.

Perianth. A collective term for sepals and petals together.

Petal. A colored, leaf-like flower part; in orchids restricted to the three inner parts, and usually to two of these (see lip).

Pistil. The female or seed-bearing element of a flower; composed of one or more carpels (3 in the orchids), and divided into ovary, style and stigma.

Pleuranthous. The inflorescence borne laterally, as in *Oncidium* or *Vanda*; the term is rarely used (see also acranthous).

Pollen. One-celled spores borne in the anther; these develop the male gametes or sperm nuclei.

Pollinarium. The complete set of pollinia with associated parts—viscidium or viscidium and stipe; the term is rarely used, but a special term is needed for the complete apparatus.

Pollinium; pl. **Pollinia.** In the orchids, a more or less compact mass of pollen; the anther may contain 2, 4, 6, 8 or 12 pollinia.

Resupinate. Having the pedicel twisted so that the part of the flower which is uppermost in bud (the lip) is on the lower side when the flower matures.

Retinaculum. = viscidium.

Rostellum. A portion of the stigma which is specialized to take part in the pollen transfer from one flower to another; the tissue which separates the anther and the functional stigma.

Sectile. The condition in which soft, granular pollinia are subdivided into small packets, which are interconnected by elastic threads; typical of *Habenaria, Zeuxine,* etc.

Sepal. Refers to the outermost, usually green, leaf-like elements in a flower; in the orchids refers to the three outer parts (see also petal).

Spur. A slender, tubular or sack-like projection from a flower part, usually a nectary; most commonly found at the base of the lip.

Stamen. The male or pollen-bearing element of a flower; composed of filament and anther.

Staminode. A sterile stamen or anther, as the median anther of *Cypripedium.*

Stelidium. = column wing.

Stigma. The terminal, receptive portion of the pistil; produces a viscid sugary material which receives the pollen and permits it to germinate.

Stipe. A non-viscid band or strap of columnar tissue which connects the pollinia to the viscidium, as in *Oncidium* and *Vanda*; the Latin form, *stipes,* is often used (see also pedicel).

Style. The slender portion of the pistil which connects the ovary and the stigma; forms a part of the column in the orchids.

Tetrad. A unit of four pollen grains. Pollen grains are produced in groups of four, and in many orchids they do not separate until after pollination.

Throat. The tubular portion of the lip, as in *Cattleya.*

Ventral. The lower side of the flower, as it is usually borne; the lip side of the flower (see also dorsal, lateral, median).

Viscid disk. = viscidium.

Viscidium; pl. **viscidia.** A viscid part of the rostellum which is removed with the pollinia as a unit, and serves to attach the pollinia to an insect or other object (*gland, retinaculum, viscid disk*).

Viscin. An elastic or somewhat viscid material which binds together the pollen grains in the pollinia of *Habenaria, Spiranthes,* etc., and in the caudicles of *Habenaria* and other genera.

Viscus. Viscid glue produced by the rostellum, especially in flowers without a viscidium; the term is rarely used.

The literature on the structure of the orchid flower is voluminous, and I will not try to give all of it here. Some of Darwin's ideas on structure have been proven wrong, but his work is still a classic. The other papers cited give more extensive bibliographies.

Darwin, C. 1862. On the Various Contrivances by which British and Foreign Orchids Are Fertilised by Insects. 365 pp., London.

Dressler, R. L. & C. H. Dodson. 1960. Classification and Phylogeny in the Orchidaceae. Annals Missouri Botanical Garden 47:25–68.

Garay, L. A. 1960. On the Origin of the Orchidaceae. Botanical Museum Leaflets, Harvard University 19:57–96.

Swamy, B. G. L. 1948. Vascular Anatomy of Orchid Flowers. Botanical Museum Leaflets, Harvard University 13:61–95.

THE Women's Association of the Garden elected new officers of the Association on February 22nd, 1961. Mrs. J. Bruce Butler was chosen as President. (See inside of back cover for list of all officers.)

Mrs. W. Warren Kirkbride, retiring President, was presented a new Orchid hybrid named in her honor "Elisabeth Upthegrove Kirkbride." Mr. Ranlet Lincoln made the presentation with the following remarks:

"I want to tell you something about this orchid. First of all, as you can see, it is beautiful. It is distinctive among orchids by its great variety of color, and is the kind of plant that becomes more and more interesting the better you come to know it. This orchid was developed here at the Garden, and while it has a distinguished ancestry, it is in its own right an outstanding leader. Among its other qualities are that it is hardy, long-lasting, responds very well to pressure and requires no special care, nor is it fussy. It also has the most important quality of being very reliable. When you need flowers in a pinch, you can always count on this orchid to come through with a beautiful performance.

"In short, our botanists and horticulturalists have considered the matter with great care, and this orchid has been judged to be worthy of the great honor which has been done it. It has been named the Elisabeth Upthegrove Kirkbride."

Mrs. J. Bruce Butler, Mrs. W. Warren Kirkbride and Mrs. John S. Lehmann admire the new orchid.

FRIENDS OF THE GARDEN

New officers for the Friends of the Garden were elected in February, with the retirement from office of former president John A. Averill. The new President is Mrs. William R. Bascom, with Mrs. Curtis Ford and Harry E. Wuertenbaecher, Jr., continuing as Vice Presidents and Mrs. Eli M. Strassner becoming a Vice President, and Sears Lehmann continuing as Treasurer. In welcoming the new officers of the Friends, Dr. Frits W. Went expressed to Mr. Averill, for the staff and trustees, the Garden's sincere appreciation of his devoted and effective service to the Organization during the past year of transition and reorganization.

MISSOURI BOTANICAL GARDEN PROGRAMS

Special Shows and Displays

Spring Flower Show, April 2 to 30, 1961.

Daffodil Show, April 15 and 16, 1961. Sponsored by the St. Louis Daffodil Society. Out of State Judging Award of five trophies.

Free Nature Programs for children, aged seven and over, are held every Saturday morning from 10:00 to 11:30 A. M.

April 1 Sowing Seed for Your Garden
8 Flower Shapes and Names
15 Hunting for Hidden Flowers
22 Spring Safari
29 More About Your Garden Seeds

COURSES FOR ADULTS BEGINNING IN APRIL

102 Plants for Your Garden. *Basic.* 8 sessions. Fee 10.00.
Tuesdays, April 25 to June 6 (One session a field trip to be arranged). 8:00 to 9:30 P. M.
Introduction to cultivated plants for particular places and uses. How to identify and recognize them by actual study of material in the laboratory and in the field. Hugh Cutler, Instructor.

110 Home Orchid Culture. 1 session. Fee $10.00.
Saturday, April 8, 10:00 A. M. to 3:00 P. M.
Orchids suitable for home culture and best ways of growing them. Potting demonstration and practice. Students may take the plant they pot home. R. J. Gillespie, Instructor.

202 Plant Materials. *Basic.* 8 sessions. Fee $10.00.
Tuesdays, April 25 to June 6 (one session a field trip to be arranged). 8:00 to 9:30 P. M.
General instruction to enable the student to identify and recognize many forms of plant life. Students will work with living material in the laboratory. Will be combined with Course 102.

210 Survey of Orchids. 5 sessions. Fee $10.00.
Wednesday, April 12 to May 10. 8:00 to 9:30 P. M.
The student will learn how to identify the many unusual and common orchids using the Garden's large collections. R. L. Dressler, Instructor.

A SERIES OF FREE LECTURES ON RESEARCH AT THE GARDEN

Given the First Monday of Each Month

Orchid Hunting in South America
Dr. C. H. Dodson, April 3, 8:00 P. M. in Museum Building.
Dr. Dodson, Taxonomist and Research Associate in the Herbarium, assisting in the preparation of the Garden's "Flora of Panama."

Cutak Reports (with slides) on a plant collecting trip to Colombia.
Ladislaus Cutak, May 1, 8:00 P. M. in Museum Building.

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SOME FACTS ABOUT SHAW'S GARDEN

The Missouri Botanical (Shaw's) Garden was established in 1859 by Henry Shaw, a St. Louis businessman, to be controlled by a Board of Trustees for the public benefit. The Garden is a non-profit institution which receives no support from the city or state, depending on the income from the Shaw estate supplemented by contributions from the public.

The old stone walls and cast-iron fences, the Linnean House, the Museum Building, the part of the Administration Building which was Shaw's Town House, relocated in the Garden in 1890, and the Tower Grove House, his country home, all date from Mr. Shaw's time. The Main Gate, display and growing greenhouses and most other facilities date from the period immediately following the turn of the century. The Climatron, opened in 1960, is the first of several new buildings planned for the Garden's redevelopment. It is the world's first geodesic dome, fully climate-controlled greenhouse and contains the Garden's tropical collections.

The Garden—70 acres—is open every day of the year (except Christmas and New Year) from 9 A. M. until sundown, the greenhouses 9 A. M. to 5 P. M., the Climatron Monday through Thursday 9 A. M. to 5 P. M., Friday through Sunday 9 A. M. to 9 P. M. Tower Grove House is open daily from 1 P. M. to 4 P. M. (December to March on weekends only). The Display House presents four seasonal displays: November, Chrysanthemums; December, Poinsettias; February, Orchids; Spring, Lilies and other flowers. During the year are other shows, competitions and festivals sponsored by various Garden Clubs and Flower Societies.

Courses in Botany and Horticulture for adults are conducted by the Garden staff. Children's nature studies are provided each Saturday of the year and a special nature program is held during the summer. Information on these activities is published in the BULLETIN or may be had by mail or phone. The Garden maintains a research program through the Henry Shaw School of Botany, Washington University.

In 1926 an Arboretum — 1600 acres — was established at Gray Summit, Missouri. Foot trails and roads pass through the Arboretum and are open to visitors in April and May.

The Garden Administration Building is located at 2315 Tower Grove Ave., and the Garden main entrance is at Tower Grove and Flora Place. The entrance at Tower Grove and Cleveland Avenue is also open to the public. The Garden is served by both the Sarah (No. 42) and the Park-Southampton (No. 80) city bus lines.

Persons interested in helping to support the Garden and taking part in Garden activities are urged to do so through the "Friends of the Garden". Information may be obtained from the Main Gate or by mail or phone.